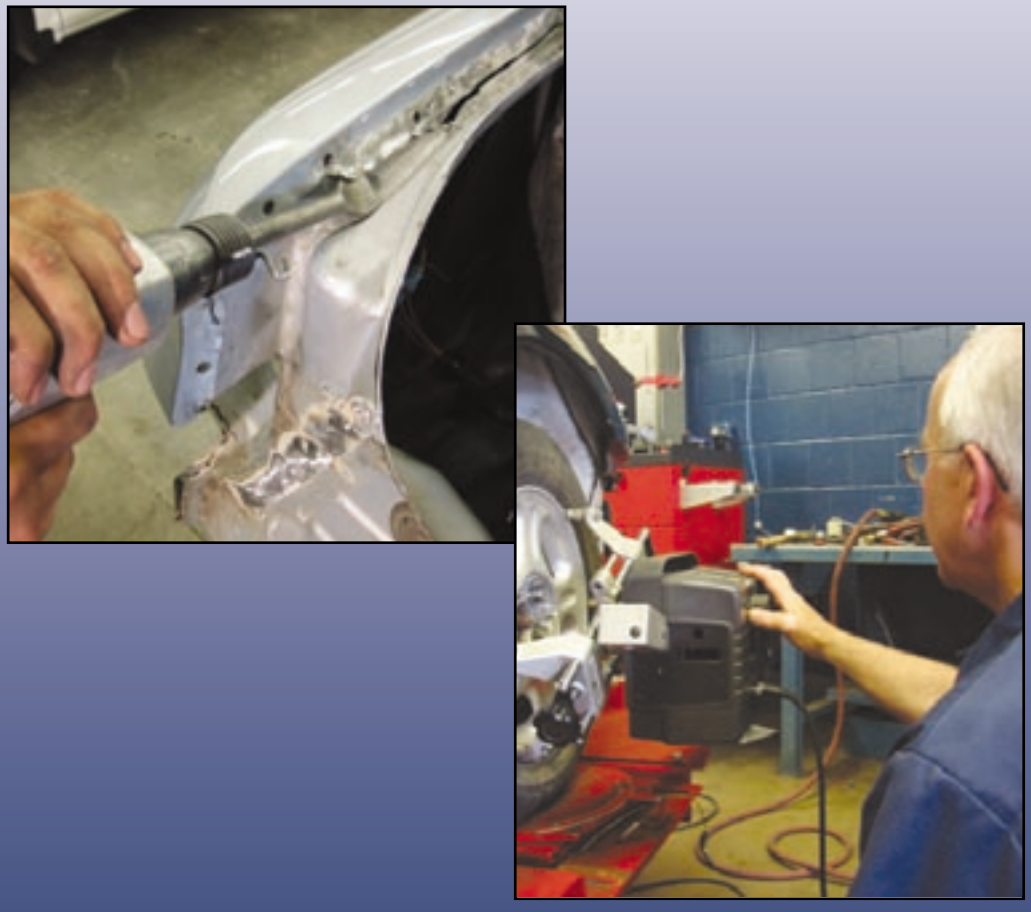
AUTO BODY REPAIR

AUTO BODY REPAIR BASICS



TEACHER'S GUIDE

SHOPWARE®

INTRODUCTION

This Teacher's Guide provides information to help you get the most out of *Auto Body Repair Basics.* The contents in this guide will allow you to prepare your students before using the program and present follow-up activities to reinforce the program's key learning points.

As the first program in the 12-part series *Auto Body Repair, Auto Body Repair Basics* introduces basic auto body repair concepts, shop areas and equipment, general shop safety procedures, career opportunities, and service ethics. After viewing this video, students will have a more detailed understanding of the types of jobs available in the auto body repair field, as well as of the tools and work areas that are typical in auto body repair shops. Use the *Auto Body Repair Basics* video and accompanying activities provided in this guide to provide students with an introduction to the automotive body repair industry, and to peak interest in career opportunities in the field.

LEARNING OBJECTIVES

After viewing the program, students will be able to:

- Identify the different areas of an auto body repair shop.
- Explain general shop safety procedures.
- Recognize general shop equipment.
- Describe potential career areas and opportunities in auto body repair.
- List standards for ethics in service delivery.

EDUCATIONAL STANDARDS

The primary certifying body for automotive technician training programs is the National Institute for Automotive Service Excellence (ASE). ASE is a non-profit organization established in 1972 by the automotive industry to improve the quality of vehicle repair and service through the voluntary testing and certification of automotive repair technicians. The National Automotive Technicians Education Foundation (NATEF) is a separate non-profit foundation within ASE. The mission of NATEF is to improve the quality of automotive technician training programs nationwide through voluntary certification. The State Departments of Education in all 50 states support ASE/NATEF certification of automotive programs.

National Standards

This program correlates with the Program Certification Standards for Automobile Technician Training Programs from the National Institute for Automotive Service Excellence (ASE) and the National Automotive Technicians Education Foundation (NATEF). The content has been aligned with the following educational standards which reflect the tasks in the ASE Program Certification Standards for Automobile General Service Technician Programs.

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Introduction to Auto Shop and Personal Safety

- Identify general shop safety rules and procedures.
- Utilize safe procedures for handling of tools and equipment.
- Identify and use proper procedures for safe lift operation.
- Utilize proper ventilation procedures for working within the lab/shop area.
- Identify marked safety areas.
- Identify the location and use of fire blankets.
- Identify the location and the types of fire extinguishers; demonstrate knowledge of the procedures for using fire extinguishers.
- Identify the location and use of eye wash stations.
- Identify the location of the posted evacuation routes.
- Comply with the required use of safety glasses, gloves, shoes during lab/shop activities.
- Identify and wear appropriate clothing for lab/shop activities.
- Comply with appropriate hairstyles for lab/shop activities.

Tools and Equipment

- Identify tools and their usage in automotive applications.
- Demonstrate safe handling and use of appropriate tools.
- Demonstrate proper cleaning, storage, and maintenance of tools and equipment.

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Language Arts and Communication Standards

According to ASE/NATEF standards, the automobile technician must be proficient in the following Language Arts and Communications related academic skills that are embedded in the occupation. The activities and information presented in this program and accompanying teacher's guide are aligned to the following standards from the National Automotive Technicians Education Foundation from the National Institute for Automotive Service Excellence.

- Request, collect, comprehend, evaluate, and apply oral and written information gathered from customers, associates, and supervisors regarding problem symptoms and potential solutions to problems.
- Identify the purpose for all written and oral communication and then choose the most effective strategies for listening, reading, speaking, and writing to facilitate the communication process.
- Adapt a reading strategy for all written materials, e.g. customer's notes, service manuals, shop manuals, technical bulletins, etc., relevant to problem identification, diagnosis, solution, and repair.
- Use study habits and techniques, i.e. previewing, scanning, skimming, taking notes, etc., when reviewing publications (shop manuals, references, databases, operator's manuals, and text resources) for problem solving, diagnosis, and repair.
- Write clear, concise, complete, and grammatically accurate sentences and paragraphs.
- Write warranty reports and work orders to include information regarding problem resolution and the results of the work performed for the customer or manufacturer.

- Comprehend and apply industry definitions and specifications to diagnose and solve problems in all automotive systems and components.
- Scan service manuals and databases to locate specific information for problem-solving purposes.
- Use the service manual to identify the manufacturer's specifications for system parameters, operation, and potential malfunctions.
- Supply clarifying information to customers, associates, parts supplier, and supervisors.

Technology Standards

The activities in this Teacher's Guide were created in compliance with the following National Education Technology Standards from the National Education Technology Standards Project. The content has been aligned with the following educational standards and benchmarks.

- Use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- Use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.
- Use technology tools to enhance learning, increase productivity, and promote creativity.
- Use technology to locate, evaluate, and collect information from a variety of sources.

The National Education Technology Standards reprinted with permission from the International Society for Technology Education.

Career Standards

This program also correlates with the National Career Development Guidelines from the National Occupational Information Coordinating Committee. The content has been aligned with the following standards from this organization.

- Understand the relationship between educational achievement and career planning.
- Demonstrate how to apply academic and vocational skills to achieve personal goals.
- Describe the relationship of academic and vocational skills to personal interests.
- Describe how skills developed in academic and vocational programs relate to career goals.
- Describe how learning skills are required in the workplace.
- Locates evaluate, and interpret career information.
- Describe the educational requirements of various occupations.
- Identify how employment trends relate to education and training.
- Demonstrate academic or vocational skills required for a full or part-time job.
- Demonstrate employability skills necessary to obtain and maintain jobs.
- Understand how societal needs and functions influence the nature and structure of work.
- Describe how occupational and industrial trends relate to training and employment.
- Describe career plans that reflect the importance of lifelong learning.
- Demonstrate knowledge of postsecondary vocational and academic programs.

The National Career Development Guidelines reprinted with permission from the Center for Civic Education.

PROGRAM OVERVIEW

What is it like to work in an auto body repair shop? What types of tools do the technicians use? What types of safety precautions are taken in a shop? These are some of the questions answered in *Auto Body Repair Basics,* introducing basic auto body repair concepts, including shop areas and equipment, general shop safety procedures, career opportunities, and service ethics. Students will have the opportunity to see actual technicians working in a shop, and see up-close the tools and safety procedures used while on the job. After viewing this program, students will have a much better understanding of the career options available in the field of auto body repair.

MAIN TOPICS

Topic 1: Career Opportunities in Auto Body Repair
Within this topic, students will learn about the various career opportunities available in the field of auto body repair. They will also find out how the size of the shop makes a difference in the types of job opportunities available.

Topic 2: Work Areas in an Auto Body Repair Shop
This section of the program introduces students to the different work areas found within typical auto body repair shops, and explores the differences between small, medium, and large shops. Students will also have an opportunity to see the types of processes and tools used for various repairs in an auto body shop.

Topic 3: Safety Procedures for Auto Body Repair
In this section, students will learn about the necessary safety procedures within an auto body repair shop. Students will be introduced to procedures used when dealing with hazardous materials, and will be taught the importance of following safety rules to prevent and respond to accidents.

Topic 4: Service Ethics
In this section, students will be taught the thirteen customer service guidelines that should be observed by any business or person involved in auto body repair, as developed by the National Dealers Association, a professional association for auto dealers.

FAST FACTS

- Before any auto body repairs can begin, an estimate of the repairs needed and repair costs must be made. Estimating involves assessing damage, then determining which parts must be replaced and which ones can be repaired.
- Collisions and the repair process itself compromise a vehicle's corrosion protection. Your job as an auto body repair technician is to make sure that corrosion protection is fully restored during the repair process. If it isn't, rust and other corrosive forces can seriously weaken the vehicle's structure and damage its appearance.

- Because of the toxic nature of many paints, paint suits with ventilated masks or hoods are essential whenever you're spraying finishes of any kind.
- Hydrogen gas that hangs around batteries can ignite, causing the battery to explode. To avoid this problem, always charge batteries in a well-ventilated area.
- In case of a gasoline fire, never use water. Water can actually spread the flames rather than put them out.
- Use pneumatic tools and compressed air with caution. A burst of compressed air, if directed at your bare skin, can sometimes force air into your blood stream and cause death.
- Hazardous materials like solvents and paint, heavy metals, and corrosive liquids cannot be flushed down floor drains or put into normal garbage containers. It's against the law and can result in heavy fines.
- Most of today's vehicle frames are built in one piece called a unibody. The benefit of a unibody to passengers is that, in a collision, the frame absorbs most of the impact, protecting the passengers inside. However, when vehicles absorb an impact, the frame can sustain damages that can be overlooked during initial inspection, so it is critical that all damages be located and repaired for the safety of passengers.
- Most automotive body repairers work a standard 40-hour week, although some, including the self-employed, work more than 40 hours a week. (Source: Bureau of Labor Statistics)
- Automotive body and related repairers held about 220,000 jobs in 2002; about 1 in 10 specialized in automotive glass installation and repair. Most repairers worked for automotive repair and maintenance shops or automobile dealers. (Source: Bureau of Labor Statistics)
- More than 1 automotive body repairer in 10 is self-employed, almost twice the proportion for all installation, maintenance, and repair occupations. (Source: Bureau of Labor Statistics)

VOCABULARY TERMS

asphyxiation: Unconsciousness or death from lack of oxygen. In the shop, asphyxiation can result from contact with an airborne substance that inhibits normal breathing.
Class A Fire: Green fire extinguishers are for Class A fires. Burning wood, paper, cloth, upholstery, rubber, plastics, or rubbish produces these fires.
Class B Fire: Red fire extinguishers are for Class B fires. Class B fires are produced by flammable liquids such as gasoline, oil, grease, paint, or lighter fluid.
Class C Fire: Blue fire extinguishers are for Class C electrical fires. They should be used on fires in electrical motors, appliances, wiring, fuse boxes and switchboards.
Class D Fire: Class D fire extinguishers are yellow, and are designed to be used on fires of combustible metals such as aluminum, titanium, or magnesium.
dealership body shop: A body shop in a dealership is owned and operated under the direction of one of the major automobile manufacturers. This type of shop often concentrates on repairing the makes and models of cars sold by the dealership.
estimating: Estimating involves assessing damage, then determining which parts must be replaced and which ones can be repaired. A cost figure is applied to each part and the labor required to repair or to replace it. Today most shops use some kind of computerized system to help with this.

franchise body shop: A franchise body shop can be owned and managed locally, but operates under a set of rules or guidelines established by the franchise company. These rules and operating procedures may specify the brands of parts to be used and pricing for services.
hydraulic frame rack: A hydraulic frame rack is used for straightening bent frames. The vehicle frame is clamped to the rack, so it can't move. Then chains are attached, and the frame is pulled or pushed back into alignment.
independent body shop: An independent body shop is locally owned and operated. That means that it doesn't have any ties with a national company. The local owner/operator sets the rules and the prices for work.
paint booth: The paint booth is a large enclosure with its own ventilation system. The ventilation system removes a lot of the paint overspray from the booth and keeps out the dust and dirt from other areas of the shop.
pneumatic tool: A tool that is powered by compressed air.

PRE-PROGRAM DISCUSSION QUESTIONS

1. What jobs are available in the auto body repair industry? Which jobs are you most interested in?
2. How many areas in an auto body repair shop can you name?
3. What are some tools that are used in an auto body repair shop?
4. What safety procedures should be taken when working in an auto body repair shop?
5. What do you think are the differences in responsibilities for auto body repair technicians in small shops as opposed to large shops?

POST-PROGRAM DISCUSSION QUESTIONS

1. Now that you have seen the *Auto Body Repair Basics* video, were there any careers in the automotive industry of which you were not aware? If so what were they? Can you think of any careers in the automotive industry that were not included in this program?
2. Describe the pros and cons of working in a large, medium, and small auto shop. In which type of shop would you most enjoy working?
3. How are the different areas of a body shop related? Is there any area in which you would not want to work? In which area do you think you would most enjoy working?
4. List the tools found in each area of a body shop. What types of skills do you think are needed to operate these tools?
5. Based on the information learned in the video, what classes do you think you should take to prepare for a job in auto body repair?
6. In your opinion, which areas within an auto body repair shop require the most attention to safety? What safety measures should be taken in these areas?
7. Why do you think the National Dealers Association created a list of ethics for auto body repair shops? How do these ethics help the customer? How do they help the repair shop?

GROUP ACTIVITIES

Design Your Own Body Shop!
Your group has decided to join forces and open a body shop. You have sufficient capital to buy the necessary equipment and lease space for your shop. As a group, decide whether to open a franchised body shop or an independent one, after weighing the pros and cons of both. Prepare a written document for your investors explaining why you made the choice that you did. Then, prepare a detailed floor plan of what your body shop will look like. Be sure to include the appropriate areas for all the needs of your business. Describe or sketch a logo for your business, and put it at the top of all documents submitted for this assignment.

Auto Body Career Presentation
Your group needs to teach the class about a specific career within the auto body repair field. As a group, decide upon a career that you think many people in your class would be interested in. Then, research the requirements of the career. You may want to start at www.bls.gov, then answer the following questions:

- What education and experience is necessary for the career?
- What tasks is someone in this career responsible for?
- What kind of salary does someone in this career make? How many jobs are available for someone in this career?

As a group, prepare a large poster or tri-fold display, including photographs or illustrations, which provide the answers to these questions. Your group should also prepare a presentation designed to persuade others to choose this career. Each group should have the opportunity to present their career to the class, and answer questions about the career.

Auto Body Repair Tools
As a group, prepare a list of the tools that you will need in an auto body repair shop. Consult the *Auto Body Repair Basics* video, the Internet, and any other sources that you have available. Divide the list into hand tools, electric tools, and hydraulic tools. Then, find or illustrate pictures of each tool. Prepare a poster for each group of tools, labeling each tool with its name and its use. Be prepared to share your posters with the class.

INDIVIDUAL STUDENT PROJECTS

Field Research
Prepare a list of jobs in the field of auto body repair, and select two or three that interest you most. Then, go and visit some shops, including a dealership shop, a franchise shop, and an independent shop. Interview the owners and employees about the jobs that interest you. What jobs are available in their shops? Do they match your list? What are the salaries associated with the jobs you are interested in? What are the tasks you would be required to do? If possible, spend time observing people doing the jobs you are interested in, and take photographs. Prepare a written report which includes your observations, interviews, and photographs, describing what you've learned about the jobs you selected.

Safety in the Shop: Safety Manual
There are many safety rules that must be observed in an auto body repair shop. Review the rules taught in the *Auto Body Repair Basics* video, research safety rules in other places such as books and on the Internet, and, if possible, visit some auto body repair shops and write down the safety rules observed in these shops. After completing your research, prepare a safety manual with at least one page for each area of a comprehensive auto body repair shop. Write down the rules that should be observed in each area of the shop, and illustrate with pictures to help readers remember the rules.

Ethics in the Shop
The National Dealers Association has produced thirteen customer service guidelines that auto body repair shops should abide by. Go to the Internet and find these rules. Then prepare a written document that explains, for each guideline, why you think the rule is necessary, and what might happen if the guideline is not abided by. Do you think any other guidelines are necessary? If so, include these in your document as well.

INTERNET ACTIVITIES

Job Search
Pick an auto body repair career that is of interest to you, and then go to at least three job sites on the Internet, such as Monster.com, Hotjobs.com, and a local or statewide job site, and search for jobs in the field that interests you. Compile the listings, and for each listing, answer the following questions:

- What kind of education do you need for this job?
- What kind of experience is required?
- Do the listings provide a salary range? What is it?
- What tasks would you be responsible for doing in this job?
- Where is the job located?
- In which kind of shop is the job located–dealership, franchise, or independent?

1969 Alpha Romeo Repair
Imagine that you own an independent body shop, and you've been asked to repair a 1969 Alpha Romeo after it's been in an accident. There is damage to the nose of the car, and the frame is out of alignment. You've also noticed some rusting. Your job is to get it back into as near perfect condition as possible. Go to the Internet and find as much information as you can about the body of the 1969 Alpha Romeo. You can start at www.diynet.com. Then, prepare an estimate for the owner detailing the repairs that need to be made (be creative), as well as how much it will cost to make each repair. Use the Internet to find the cost of labor, part replacements, and any other materials you need to do the repair. Remember, your pricing must be competitive in order to get the job! Be sure to include your company's logo (from the "Design Your Own Body Shop!" Group Activity) on the estimate.

Discussion Forums
Visit www.autobodyonline.com and enter the discussion forums. Post a question asking about the auto body career of your choice. Ask about duties and salaries, and ask for advice about breaking into the field. Also, review the other posts within the forums and see if you can gather any other information about the career you are considering. After a week, copy all your responses, as well as any other posts you have seen that are relevant, into a word processing document. Then answer the following questions: What have you learned as a result of the answers you received to your post? What have you learned from reading other posts? Has any of the information you read changed your mind about your career choice, or has it affirmed that you made a good choice?

ASSESSMENT QUESTIONS

Q: Which of the following is NOT a type of auto body repair shop?
(a) Dealership
(b) Franchise
(c) Government
(d) Independent
A: (c)
Feedback: Dealerships often have auto body repair shops that are owned and operated under the direction of one of the major automobile manufacturers. This type of shop often concentrates on repairing the makes and models of cars sold by the dealership. Franchise auto body repair shops can be owned and managed locally, but operate under a set of rules or guidelines established by the franchise company. Independent body shops are locally owned and operated, and the owner sets the rules and pricing.

Q: If you are interested in specializing in a particular part of the auto body repair business, you will most likely want to work in a _____ auto body repair shop.
A: large
Feedback: Many of the larger auto body repair shops are looking for people who specialize in a particular part of the business like painting and refinishing, bodywork, or mechanical and electrical repairs.

Q: Before any repairs can be made to a vehicle, what must be done first?
A: An estimate of the repairs needed and repair costs must be made.
Feedback:. Estimating involves assessing damage, then determining which parts must be replaced and which ones can be repaired. A cost figure is applied to each part and the labor required to repair or to replace it.

Q: After the insurance company provides approval for the repairs, which of the following is the first step in the auto body repair process?
(a) Bodywork
(b) Washing
(c) Painting
(d) Welding
A: (b)

Feedback: When it is time to begin repairs, the vehicle first enters the wash-up area. Washing the vehicle removes any dirt, wax, oil, grease, and water-soluble contaminants that may interfere with repairs and refinishing.

Q: The bodywork area is usually the largest area in the auto body repair shop. *(True or False)*
A: True
Feedback: The bodywork area is usually divided into individual repair stalls or bays, each of which can accommodate one vehicle. Here is where most of the metal work is done—everything from repairing minor dents and scratches, to frame straightening, to application of the finishing touches before the vehicle is returned to its owner.

Q: Most bodywork areas contain a _____ for straightening bent frames.
A: hydraulic frame rack
Feedback: When a hydraulic frame rack is used for straightening bent frames, the vehicle frame is clamped to the rack so it can't move. Then chains are attached, and the frame is pulled or pushed back into alignment.

Q: What must be done before applying a final finish on a vehicle?
A: The surface of the vehicle must be properly prepared, or the paint won't adhere properly.
Feedback: Proper preparation means making sure all surfaces are clean of wax, dirt, grease, and silicone, and that bare metal is properly primed. Surface scratches and pinholes must be filled and sanded smooth. Any painted areas that are to be refinished must be scuff-sanded, cleaned of all dirt and grit, and sealed.

Q: What is a paint booth?
A: A paint booth is a large enclosure with its own ventilation system where a vehicle is painted after repairs have been made.
Feedback: The ventilation system removes a lot of the paint overspray from the booth and keeps out the dust and dirt from other areas of the shop.

Q: Which of the following should be done to prevent static electricity from causing an explosion when transferring flammable liquids?

(a) Ground the drum
(b) Use a red gasoline container for all flammable liquids
(d) Wipe up spills immediately with water
(d) Pour the liquid directly into the container without using any other devices

A: (a)
Feedback: Use only a UL approved drum transfer pump when transferring flammable liquids. Ground the drum to prevent static electricity from causing an explosion.

Q: Which of the following colors indicates the type of fire extinguisher that should be used for Class C electrical fires?

(a) Green
(b) Red
(c) Yellow
(d) Blue

A: (d)
Feedback: Blue extinguishers are for Class C electrical fires. They should be used on fires in electrical motors, appliances, wiring, fuse boxes, and switchboards.

ADDITIONAL RESOURCES

WEB SITES

Auto Body Online
www.autobodyonline.com

Auto Body Pro
www.autobodypro.com

Auto Body Tool Mart Repair and Restoration Tutorials
www.autobodytoolmart.com/restorations.html

Auto Glossary
www.autoglossary.com

Automotive Body Repair News
www.abrn.com/abrn

Automotive Services Association
www.asashop.org

Automotive Youth Educational Systems (AYES)
www.ayes.org

How Stuff Works—Auto Stuff Page
http://auto.howstuffworks.com

I-car
www.i-car.com

National Automobile Dealers Association Ethics Guide
www.nada.org

National Automotive Technicians Education Foundation
www.natef.org/program_standards/collision/index.cfm

Society of Collision Repair Specialists
www.scrs.com

Vocational Information Center: Auto Body Career Resources
www.khake.com/page11.html

Bureau of Labor Statistics—Automotive Body and Related Repairers
www.bls.gov/oco/ocos180.htm

BOOKS

Duffy, James E. *I-CAR Professional Automotive Collision Repair.* Albany, NY: Delmar Thomson Learning, 2001. ISBN: 0766813991

Duffy, James E. *Auto Body Repair Technology, 4th Edition.* Clifton Park, NY: Thomson/Delmar Learning, 2003. ISBN: 0766862747

Freund, Ken, et al. *The Haynes Automotive Electrical Manual.* Newbury Park, CA: Haynes Pub. Group, 2000. ISBN: 1850106541

Killingsworth, Jeff, Eric Godfrey, and John H. Haynes. *The Haynes Suspension, Steering And Driveline Manual.* Newbury Park, CA: Hayes North America, 1998. ISBN: 1563922932
Scharff, Robert, and James E. Duffy. *Motor Auto Body Repair, 3rd Edition.* Albany, N.Y.: Delmar Publishers, 1998. ISBN: 0827368585

OTHER PRODUCTS

Auto Shop Safety, VHS/DVD, Meridian Education
Stresses that if safety rules are not followed in an auto shop, serious injury or death can occur. Running engines, moving cars, cars on jack stands or floor jacks, open fuel lines, and other things all have the potential to cause a catastrophe. Methods for preventing accidents are shown and emphasized.
Order #: 24746, www.meridianeducation.com, 1-800-727-5507

Multimedia Auto Shop Safety, CD-ROM, Shopware
This multimedia CD-ROM uses video, animation and still photos to examine the topics of general shop safety, fire safety and prevention, first aid, and safe tool use for mechanics. The segment dealing with overall shop safety emphasizes the link between cleanliness and organization, as well as personal safety considerations of glasses, earplugs, shoes, and clothes. The first aid portion suggests that a certified first aid class be taken, but it offers an excellent survey of first aid practices, including what NOT to do. Correct fire extinguisher usage is illustrated by memorable graphics. The auto workshop is portrayed as a work site of numerous potential hazards, while at the same time the viewer is taught how to cope with the challenges of volatile auto products, damaged electrical cords, and welding cylinders and their contents. The mechanic's tools are shown to be a statement of their owner's professionalism. It seeks to foster that professionalism by describing the safe care and use of hand and power tools, wrenches, auto body tools, and measuring devices. (Windows/Macintosh)
Order #: 20463, www.shopware-usa.com, 1-800-487-3392

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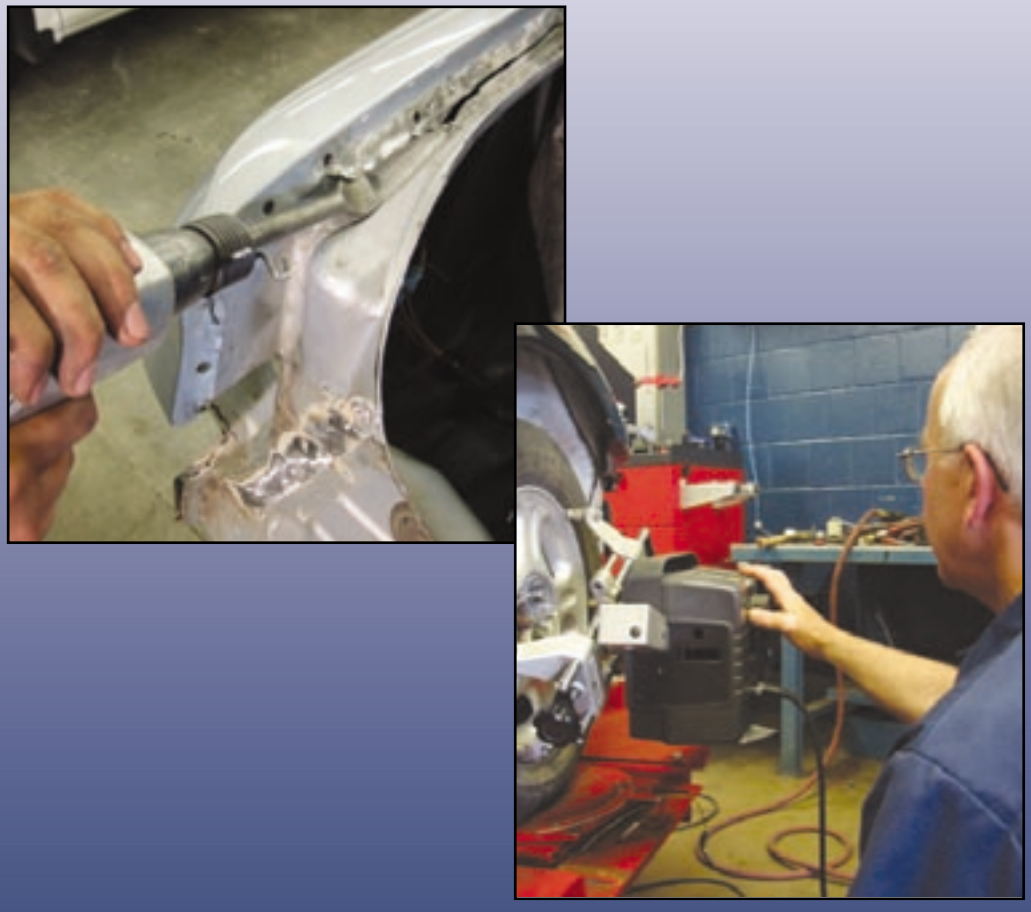
Call Toll Free: 8800/487-3392

AUTO BODY REPAIR

AUTO CONSTRUCTION



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INTRODUCTION

This Teacher's Guide provides information to help you get the most out of *Auto Construction.* The contents in this guide will enable you to prepare your students before using the program and present follow-up activities to reinforce the program's key learning points.

As part of the 12-part series *Auto Body Repair*, *Auto Construction* describes the various parts and sections of a vehicle, and the way in which auto design impacts the diagnosis and repair of damaged vehicles. After viewing this video and completing some of the learning activities included in this guide, students will be better prepared to properly diagnose and repair damaged vehicles, and incorporate industry terminology in order to communicate effectively with coworkers, parts suppliers, and insurance adjusters. Use the *Auto Construction* video and accompanying activities provided in this guide to prepare students for the most effective way to approach auto body repairs, and to familiarize students with terminology used in the auto repair industry.

LEARNING OBJECTIVES

After viewing the program, students will be able to:

- Identify the components of the automobile body and frame.
- List common types of assemblies, suspensions, and frame constructions.
- Explain why, to ensure proper auto body repair, it is important to understand how an automobile is constructed.

EDUCATIONAL STANDARDS

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Vehicle Construction

- Identify type of vehicle construction (space frame, unibody, body over frame).
- Recognize the different damage characteristics of space frame, unibody, and body over frame vehicles.
- Identify impact energy absorbing components and repair/replacement procedures.
- Identify steel components and repair/replacement procedures.
- Identify aluminum/magnesium components and repair/replacement procedures.
- Identify plastic/composite components and repair/replacement procedures.

General Operations

- Identify parts industry terminology.

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- Request, collect, comprehend, evaluate, and apply oral and written information gathered from customers, associates, and supervisors regarding problem symptoms and potential solutions to problems.
- Identify the purpose for all written and oral communication and then choose the most effective strategies for listening, reading, speaking, and writing to facilitate the communication process.
- Adapt a reading strategy for all written materials, e.g. customer's notes, service manuals, shop manuals, technical bulletins, etc., relevant to problem identification, diagnosis, solution, and repair.
- Use study habits and techniques, i.e. previewing, scanning, skimming, taking notes, etc., when reviewing publications (shop manuals, references, databases, operator's manuals, and text resources) for problem solving, diagnosis, and repair.
- Write clear, concise, complete, and grammatically accurate sentences and paragraphs.
- Write warranty reports and work orders to include information regarding problem resolution and the results of the work performed for the customer or manufacturer.
- Follow all oral/written directions that relate to the task or system under study.
- Comprehend and apply industry definitions and specifications to diagnose and solve problems in all automotive systems and components of the automobile and light truck.
- Comprehend and use problem-solving techniques and decision trees that are contained in service manuals and databases to determine cause-and-effect relationships.
- Use the service manual to identify the manufacturer's specifications for system parameters, operation, and potential malfunctions.
- Supply clarifying information to customers, associates, parts supplier, and supervisors.

Technology Standards

The activities in this Teacher's Guide were created in compliance with the following *National Education Technology Standards* from the National Education Technology Standards Project. The content has been aligned with the following educational standards and benchmarks.

- Use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- Use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.
- Use technology tools to enhance learning, increase productivity, and promote creativity.
- Use technology to locate, evaluate, and collect information from a variety of sources.

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PROGRAM OVERVIEW

Are some vehicles easier to repair than others? How does vehicle design and construction impact the work of auto body repair technicians? What challenges do auto body repair technicians face when repairing certain types of vehicles? These are some of the questions answered in this compelling video. The program describes the various parts and sections of a vehicle, including the characteristics of vehicle parts and their relationship to one another, and the way in which auto design impacts the diagnosis and repair of damaged vehicles. Viewers will have the opportunity to closely examine the design and construction of various frames and the three auto body sections, including the major parts, panels, and assemblies housed in each one. After viewing this program, viewers will be better prepared to properly diagnose and repair damaged vehicles, and able to incorporate industry terminology in order to communicate effectively with coworkers, parts suppliers, and insurance adjusters.

MAIN TOPICS

Topic 1: Basic Auto Frame Styles

This section describes the three basic frame styles used in the construction of small trucks and automobiles on the road today. Students will learn the characteristics of each frame type, including variations among frame designs, and the advantages and challenges auto repair technicians face when repairing or replacing each type.

Topic 2: Auto Body Sections

This section of the program describes the three body sections of a vehicle that auto body professionals often refer to when discussing collision repairs. Students will closely examine the major parts, panels, and assemblies housed in each section, and learn how their construction impacts repair and replacement.

FAST FACTS

- The frame of a vehicle is its foundation, similar to the foundation of a house. All other parts and assemblies are attached directly or indirectly to the frame.
- The three basic frame styles used in the construction of today's small trucks and automobiles are body-over-frame (or BOF), unibody, and space frame.
- The body-over-frame design utilizes strong steel that is about 1/8-inch thick, which is formed in U- or box-shaped sections to which body parts are bolted. This type of frame is characterized by two steel rails that run the length of the vehicle and welded-on cross-members that attach the frame rails to each other. Variations of the BOF design include the perimeter frame, X-frame, combination frame, and ladder frame.
- Due to the BOF's simplified structure repairs are easily checked for accuracy and are easily made, as opposed to repairs on other frame designs, because most body parts are bolted rather than welded or bonded to the frame.
- Most of today's vehicle frames are built in one piece, called a unibody, which is constructed by welding, bolting and adhesive-bonding the various body parts together, creating a strong, structural "shell." Unibody frames protect passengers during a collision by absorbing most of the impact, but the frame can sustain damages that can be overlooked during initial inspection.
- Repair of unibody vehicles is challenging because both the roof and quarter panels are often welded or bonded into place by adhesive for structural strength. Removing and replacing a damaged roof or quarter panel can be more time-consuming than in a BOF vehicle.
- A space frame is a lightweight aluminum frame consisting of a strong steel cage that is covered with plastic or composite panels, which typically clip on or are adhesive-bonded to the frame.
- Repair of space frames is easier than unibody frames, since the panels on a space frame can be removed without affecting the structural strength of the vehicle; but like unibody frames, space frames are more likely to have hidden damage.
- When discussing collision repairs, auto body professionals often refer to three body sections: the front section, the center or midsection, and the rear or tail section.
- The front section, or front-end assembly, includes everything from the bumper to the cowl–the part of the body just in front of the windshield.
- The center, or midsection, includes the floor pan, pillars, rocker panels (doorsills), rear bulkhead, roof, dash assembly, and doors.
- The rear or tail section includes the trunk floor panel, inner wheel housing, rear and lower quarter panels, and the trunk lid.
- Needed parts are often called out by right side and left side. In American vehicles, the right side is the passenger side and the left side is the driver's side, where the steering wheel is located.

VOCABULARY TERMS

battery tray: A flat structure that supports the vehicle's battery.
body bracket: The area of a frame that provides places to attach body components.
body-over-frame (BOF): A heavy frame type that is characterized by two 1/8-inch steel frame rails that run the length of the vehicle, and welded-on crossmembers that attach the frame rails to each other. Body parts are bolted rather than welded or bonded to the frame.
bumper assembly: An assembly that consists of a plastic bumper cover and an inner steel or aluminum bumper and grille, which bolts to the front frame horns in a conventional frame or to the frame rails that extend out near the bottom of the front section of a unibody frame. Some vehicles have a plastic honeycomb or foam structure that is designed to compress and absorb the energy of a front-end collision.
combination frame: A frame consisting of a perimeter frame and an X-frame that is one of the heaviest and strongest frames made.
control arm suspension (independent suspension): A front suspension that is attached to the frame, consisting of upper and lower control arms that are of different lengths, ball joints, coil springs, and shock absorbers, which is designed to reduce tire scuffing.
cowl assembly: The part of a car's body located directly in front of the windshield, which includes the top cowl panel and side cowl panels that extend down on either side of the body.
crossmember: A part of the underbody structure of a vehicle that extends from one side of the frame to the other or from one side of the unibody to the other.
dash (front bulkhead or firewall): The area of a vehicle that divides the vehicle's front section from its midsection or passenger compartment, which is usually welded into place.
dash assembly (instrument panel): The panel that holds the padded dash, instrument assembly, and the AC, heat, and sound system controls.
door assembly: Structure that consists of an outer skin, an inner stamped metal frame that includes an intrusion beam, door handles and locks, door latches and striker plates, window glass, and a window regulator that raises or lowers the glass with the push of a button or the turn of a crank.
floor pan: The main structural panel, usually comprised of one piece of stamped steel, in the center or midsection of a vehicle that forms the floor of the interior of the vehicle.
frame: The structural foundation of a vehicle to which all other parts and assemblies are attached directly or indirectly.
frame horns: The front ends of side rails on a body-over-frame where the bumper attaches.
front fender: A component that extends from the front bumper to the front doors, and covers the front suspension and the inner fender aprons.
front section/front-end assembly: The section of a vehicle that includes everything from the bumper to the cowl–the part of the body just in front of the windshield.
hood: The hinged panel that covers the engine compartment.
hood hinge: Components that attach the hood to the cowl.
inner fender skirt/front fender apron: Panels that are often attached to the front rails and cowl assembly and surround the front wheels to keep road debris out of the engine compartment.
inner wheel housing: Panels that surround the rear wheels and deflect road debris.
ladder frame: A conventional (BOF) frame design that consists of two side rails, not necessarily parallel, connected to each other by a series of cross members like a ladder.

lower rear panel: The panel that extends from one quarter panel to the other and forms the bottom side of the trunk.
partial frame: A cross between a conventional frame (BOF) and a unibody: the center section consists of unibody construction, while the front and rear are composed of sub-frame assemblies.
perimeter frame: A common type of conventional (BOF) frame found on pick-up trucks and vans consisting of side rails that extend the full length of the vehicle and surround the passenger compartment.
pillars: The vertical supports for the roof that protect passengers during roll-over, or from an impact on the roof of the vehicle.
radiator core support: The structural framework that is usually fastened to the inner fender aprons and the frame rails and which holds the radiator and related cooling system parts in place.
rear bulkhead: Panel that separates the passenger compartment from the trunk and rear section of the vehicle.
rocker panels/doorsills: The high-strength beams at the bottom of the door openings that are normally welded to the floor pan, pillars, and quarter panels.
roof: The large panel that is welded to the pillars for strength.
side intrusion beam: A structural element within a door that protects passengers from side impacts.
sub-frame assembly: Partial frames and body components that together support the suspension system and drivetrain.
McPherson strut system: A shock-absorbing front suspension system typically used in unibody vehicles consisting of a coil spring, upper suspension locator, and shock absorber that is mounted vertically between the top arm of the steering knuckle and the strut tower on the front fender apron.
rear assembly: The stamped metal panel that is often welded to the rear rails, inner wheel houses, and lower rear panel, which includes the trunk floor panel that forms the bottom of the trunk and often provides a "well" for storing the spare tire.
quarter panels: The large side panels in a unibody vehicle extending from the rear doors to the rear bumper, which are attached to the inner wheel houses, rear pillars, trunk floor panel, and rear crossmember.
rocker panels (doorsills): High-strength beams at the bottom of the door openings that are normally welded to the floor pan, pillars, and quarter panels.
shell: The strong structure of a unibody vehicle formed by welding, bolting, and adhesive bonding the various body parts together.
shock or strut tower: The part of the front fender apron that holds the upper parts of a strut suspension system in place.
space frame: Type of lightweight aluminum frame consisting of a high-strength steel cage that is covered with plastic or composite panels, which typically clip on or are adhesive-bonded to the frame.
torque boxes: Components that allow the frame to absorb twisting motion as the vehicle encounters bumps in the road.
trunk lid or hatch: A hinged panel covering the rear storage area that includes hinges, a lock, latch, and striker plate.

unibody: A term used to describe vehicles in which the frame rails and body panels are connected as one unit, which provide the structural strength to the vehicle. This frame type is most often found in present-day vehicles.
x-frame: A type of conventional (BOF) frame design that is typically found on older cars, convertibles, and large American cars, consisting of two long rails that cross over in the middle of the center section forming a thick beam or center backbone.

PRE-PROGRAM DISCUSSION QUESTIONS

1. Do you know the type of frame your vehicle or family vehicle has? If so, what type of frame is it? If not, how might you find out what type of frame it is?
2. How might auto construction and design influence the repair of vehicles?
3. If given the opportunity to win a free vehicle of your choice, what type of auto would you choose based on your current knowledge of auto design, and why?
4. If given the opportunity to design your own automobile, what changes would you make to current styles without compromising safety or performance?
5. Today the X-frame can be found in delivery trucks, but is no longer used in the construction of passenger autos. Considering the design of this frame, why do you think this is?

POST-PROGRAM DISCUSSION QUESTIONS

1. Now that you have seen the *Auto Construction* video, what type of frame would you most prefer to repair or replace, and why? What type of frame would you least prefer to repair or replace, and why?
2. As a group, list the three types of frame designs and the advantages and challenges each one poses to auto body repair professionals.
3. What are the three body sections of a vehicle that auto body repair technicians often refer to when discussing collision repairs? What types of components or parts are housed in each section?
4. Why is it important to have an understanding of automobile construction in relation to proper auto body repair?
5. In your opinion, what do you think is the most challenging aspect of auto body repair?

GROUP ACTIVITIES

Become a Songwriter
Your group has been hired to create a jingle or song for an auto body repair establishment for advertising purposes. They have asked that you begin with a popular pop, rock, or rap song and rewrite the words to advertise their area of expertise. As a group, decide which type of frame the auto body repair establishment specializes in, but do not include the name of the auto frame design. For example, if the auto body repair shop specializes in unibody styles, do not include that information. Draft a song that incorporates the characteristics of the frame style that you learned about in the *Auto Construction* video. Before presenting your

song, inform the audience that they should be prepared to identify the type of frame you are singing about. Present the song to the class, using sound effects, if desired. Then, invite the class to identify the frame style in your jingle or song.

Frame Repair Talk Show
Your group is appearing on a talk show to discuss repairing a unibody frame, the most common frame design found in vehicles today. As a group, research the answers to the questions listed below.

- What are the steps in the unibody repair process?
- What are the major parts, panels, and assemblies housed in the body sections?
- What are some of the specific steps in the repair process that might require the skills of a trained technician?
- What are some of the tools that are used during the repair process?

Use the following URL to begin your search:
http://www.natef.org/program_standards/collision/task_list_3.cfm

As a group, present your findings to the class in the form of a talk show. Appoint one student as the host, and the others as guest speakers. Prepare a script in interview format using the questions above. Involve the "audience" at the end of the presentation in a question and answer format. *Optional:* Prepare a handout(s) of your findings to distribute to the audience.

Approaching Auto Body Repair—Questions to Ask
As a group, prepare a list of critical factors that auto body repair technicians should initially consider when approaching auto body repairs for the three basic frame styles. Consult the *Auto Construction* video, the Internet, and any other sources that you have available. Jot down a list of questions that need to be answered, or individuals you should consult, before a repair technician would begin the task of repairing a damaged vehicle. You do not have to provide answers to the questions, only the questions about what should be considered for the particular frame design, such as "Does this frame type often conceal hidden damage?" Divide the list into body-over-frame (BOF), unibody, and space frame. Then, prepare a brochure for each frame style that lists concerns that should be considered that will enable apprentice auto body repair technicians to better understand the potential advantages and challenges of repairing each frame type. Be prepared to share your brochures with the class.

INDIVIDUAL STUDENT PROJECTS

Factory Publications Research *(Prerequisite required)*
In the beginning of this program your instructor asked, "If given the opportunity to win a free vehicle of your choice, what type of auto would you choose based on your current knowledge of auto design, and why?" Do you remember the vehicle you selected? Most, if not all, auto manufacturers publish factory publications for cars, pickup trucks, vans, and SUVs. Contact (by phone, personal visit, letter, etc.) an auto factory and request factory service information for your *dream machine*. (Some guides may be found online at car manufacturers' web sites.) Factory publications provide specifications, detailed procedures, and other information specific to the year, make, and model of the vehicle being repaired. This information is

often needed to do professional, quality work. Prepare a one-page summary of informative and procedural information about repairing your dream machine, using the information you obtain from the factory publication. You may also want to consult http://www.carcentral.net/content/pictures.php to acquire a picture of your dream car to include in the written summary.

Field Research—A Day in the Life

What is a typical day like for an auto body repair technician? One way to learn about the profession is to visit a local auto boy repair shop and speak with an experienced auto body repair professional. Contact (call or visit) a local auto body repair establishment and ask them if they could arrange a 15-minute interview for you to speak with an auto body repair professional who has comprehensive experience in the field of frame repair. Inform them of the purpose of your request. Prepare a set of open-ended questions, such as those your instructor asked before reviewing the video. You may use the following questions as you interview the auto body repair technician:

- What type of frame would you most prefer to repair or replace, and why? What type of frame would you least prefer to repair or replace, and why?
- Why is it important to have an understanding of automobile construction in relation to proper auto body repair?
- In your opinion, what do you think is the most challenging aspect of auto body repair?
- What is a typical day like for you?
- What, if any, new technologies are being introduced that will improve accuracy and/or ease of frame repair?
- After completing your research, prepare a presentation about your discussion with the auto body repair technician. You may share your findings with the class by presenting an oral report or a PowerPoint demonstration.

Consulting Auto Repair Publications

Many publications exist in the auto body repair field. Visit your local library and consult the magazine section for publications about auto body repair. Some of these publications are also available online. You may also purchase a magazine of your choice at any retail outlet. Examples of popular auto body repair magazines include:

Automotive Body Repair News—Monthly publication serving the collision repair industry. Aimed primarily at collision repair shop owners and technicians. http://www.abrn.com/abrn/issue/issueList.jsp?id=37

Popular Mechanics—Features regular columns covering many facets of automotive maintenance and repairs. “Saturday Mechanic” provides step-by-step instruction on a single complex repair, while “Maintenance Basics” covers less complex repairs. “Car Clinic” consists of questions from readers answered by editors, and covers several topics in each issue.

Locate an article about the repair of one or more frame designs. Recap the key points cited in the article in a one-page report. In your report, include the magazine name, issue, and author of the article you referenced. Also, include one fact or issue you found the most interesting, and why you found it fascinating.

INTERNET ACTIVITIES

Auto Construction and Crash Compatibility
According to the Insurance Institute for Highway Safety, weight by itself is not the only factor that influences crash outcomes. Other design characteristics influence outcome as well. Log onto http://www.hwysafety.org and research the factors that influence property damage and death rates in relation to vehicle design. Write a one-page summary about the role weight, stiffness, and geometry play in crash compatibility.

Collision Repair and High Tech
What can happen to a car's frame in a typical collision? Why is the frame so important? Can visual inspection overlook frame damage? There is a revolution going on in the way frame damage is analyzed and repaired. Visit www.framefacts.com and click on all of the links to discover how technology is aiding auto body professionals in their diagnosis of frame damage. After completing your research, prepare a bulleted list of key elements for each of the following categories: hidden frame damage, the ways frames react in collisions, frame integrity, and inspection methods.

Discussion Forums
Visit www.autobodyonline.com and enter the discussion forums by clicking the "Discussion" tab in the upper left corner of the website's homepage. Post a question about vehicle frame construction. Ask about the advantages and challenges that experienced auto body repair technicians have faced when tackling repairs. Also, review the other posts within the forums and see if you can gather any other information about frame design, or about the major parts, panels, and assemblies housed in each body sections. After a week, copy all your responses, as well as any other posts you have seen that are relevant, into a word processing document. Then answer the following questions: What have you learned as a result of the answers you have received to your post? What have you learned from reading other posts? Did any of the responses conflict with one another? If so, what issues did they raise?

Activity Title
Visit www.autobodyonline.com and enter the discussion forums. Post a question asking about the auto body career of your choice. Ask about duties and salaries, and ask for advice about breaking into the field. Also, review the other posts within the forums and see if you can gather any other information about the career you are considering. After a week, copy all your responses, as well as any other posts you have seen that are relevant, into a word processing document. Then answer the following questions: What have you learned as a result of the answers you received to your post? What have you learned from reading other posts? Has any of the information you read changed your mind about your career choice, or has it affirmed that you made a good choice?

ASSESSMENT QUESTIONS

Q: Technician A says that repairs to a unibody vehicle are easier to perform than those in a body-over-frame vehicle because panels in a unibody vehicle are often welded or bonded into place by adhesive. Technician B says that repairs to a body-over-frame vehicle are easier to perform in comparison to other frame designs because most body parts are bolted rather than welded or bonded to the frame. Who is correct?

(a) Technician A
(b) Technician B
(c) Both A and B
(d) Neither A nor B

A: (b)
Feedback: Due to the simplified structure of the body-over-frame design, repairs are easier to perform in comparison to other frame designs because most body parts are bolted rather than welded or bonded to the frame. Repair of unibody vehicles is challenging because panels are often welded or bonded into place by adhesive for structural strength. For example, removing and replacing a damaged roof or quarter panel on a unibody vehicle can be a more time-consuming repair than in a body-over-frame vehicle.

Q: Which one of the following frame designs is NOT a variation of body-over-frame construction?

(a) Space frame
(b) Perimeter frame
(c) X-frame
(d) Ladder frame

A: (a)
Feedback: Variations of the body-over-frame design include the perimeter frame, X-frame, combination frame, and ladder frame in which most body parts are bolted rather than welded or bonded to the frame. A space frame is a lightweight aluminum frame consisting of a strong steel cage that is covered with plastic or composite panels, which typically clip on or are adhesive-bonded to the frame.

Q. Which body section includes the floor pan, pillars, rocker panels (doorsills), rear bulkhead, roof, dash assembly, and doors?

(a) Front section
(b) Center or midsection
(c) Tail or rear section
(d) None of these sections

A: (b)
Feedback: The center or midsection includes the floor pan, pillars, rocker panels (doorsills), rear bulkhead, roof, dash assembly, and doors. The front section, or front-end assembly, includes everything from the bumper to the cowl—the part of the body just in front of the windshield. The rear or tail section includes the trunk floor panel, inner wheel housing, rear and lower quarter panels, and the trunk lid.

Q: Since there is no separate heavy-gauge steel frame under a unibody frame, how is structural strength achieved?
A: Structural strength of a unibody frame is achieved through the shape and design of the components, rather than by mass and weight.
Feedback: In unibody frame construction, a strong, structural "shell" is created for the vehicle by welding, bolting and adhesive bonding the various body parts together. There is no separate heavy-gauge steel frame under the body because none is needed. Structural strength of a unibody frame is achieved through the shape and design of the components that cause force exerted on one point of the shell to spread out or diffuse to other parts to resist breakage.

Q: Damaged space frame vehicles are more likely than other body types to have hidden damage. *(True or False)*
A: True
Feedback: Space frames have plastic or composite body panels that do not deform on impact the way metal does. Therefore, collision damage to the interior frame structure may be more substantial than indicated from the outside. Also, the panels may mask the extent of interior corrosion because plastic does not rust.

Q: Technician A says that a perimeter frame has good side impact strength because the side rails extend the full length of the vehicle and surround the passenger compartment. Technician B says that a perimeter frame has good side impact strength because front and rear crossmembers support the engine, suspension and drivetrain, and the floor pan is bolted to the center section, adding more stability and resistance to twisting loads. Who is correct?

(a) Technician A
(b) Technician B
(c) Both A and B
(d) Neither A nor B

A: (c)
Feedback: The perimeter frame, the most common type of conventional (BOF) frame in use today, has good impact strength because the side rails extend the full length of the vehicle and surround the passenger compartment; the front and rear crossmembers support the engine, suspension and drivetrain; and the floor pan is bolted to the center section adding more stability and resistance to twisting loads.

Q: _____ vehicles tend to be heavier than other frame types and ride higher off the ground, but are extremely strong.
A: Body-over-frame
Feedback: Body-over frame vehicles, such as pickup trucks, vans, and SUVs, tend to be heavier than other frame types and ride higher off the ground, but are extremely strong.

Q: What type of knowledge must auto body repair technicians possess in order to communicate effectively with coworkers, parts suppliers, and insurance adjusters?
A: Auto body repair technicians must be familiar with the terminology used in the auto body repair industry regarding frame styles, and major parts, panels, and assemblies housed in each body section.
Feedback: To communicate effectively with coworkers, parts suppliers and insurance

adjusters, auto body repair technicians must be familiar with the terminology used in the auto body repair industry, such as the name of frame styles, body sections, parts, assemblies, and panels. Auto body repair professionals must also be familiar with all of the various automotive parts and the way in which they interrelate in order to properly diagnose and repair damaged vehicles.

Q: How does vehicle construction impact the work of auto body repair technicians?
A: Vehicle construction impacts the extent of damage, the time needed to make necessary repairs, the potential for hidden damage, and the ease in which repairs are performed.
Feedback: Frame design and the manner in which vehicle parts are fastened to the structure will determine the extent of damage, the time needed to make necessary repairs, the potential for hidden damage, and the ease in which repairs are performed.

Q: All vehicle parts and assemblies are directly attached to a separate frame. *(True or False)*
A: False
Feedback: All vehicle parts and assemblies are attached directly or indirectly to the vehicle frame. In unibody frame construction, a strong, structural "shell" is created for the vehicle by welding, bolting and adhesive bonding the various body parts together. There is no separate heavy-gauge steel frame under the body because none is needed. In space frame construction, a lightweight aluminum frame consisting of a high-strength steel "cage" is covered with plastic or composite panels, which typically clip on or are adhesive-bonded to the frame.

ADDITIONAL RESOURCES

WEB SITES

Auto Body Online
www.autobodyonline.com

Auto Body Pro
www.autobodypro.com

Auto Body Tool Mart Repair and Restoration Tutorials
www.autobodytoolmart.com/restorations.html

Auto Glossary
www.autoglossary.com

Automotive Body Repair News
www.abrn.com/abrn

Automotive Services Association
www.asashop.org

Automotive Youth Educational Systems (AYES)
www.ayes.org

How Stuff Works—Auto Stuff Page
http://auto.howstuffworks.com

I-car
www.i-car.com

National Automobile Dealers Association Ethics Guide
www.nada.org

National Automotive Technicians Education Foundation
www.natef.org/program_standards/collision/index.cfm

Society of Collision Repair Specialists
www.scrs.com

Vocational Information Center: Auto Body Career Resources
www.khake.com/page11.html

Bureau of Labor Statistics—Automotive Body and Related Repairers
www.bls.gov/oco/ocos180.htm

BOOKS

Duffy, James E. *I-CAR Professional Automotive Collision Repair.* Albany, NY: Delmar Thomson Learning, 2001. ISBN: 0766813991

Duffy, James E. *Auto Body Repair Technology, 4th Edition.* Clifton Park, NY: Thomson/Delmar Learning, 2003. ISBN: 0766862747

Freund, Ken, et al. *The Haynes Automotive Electrical Manual.* Newbury Park, CA: Haynes Pub. Group, 2000. ISBN: 1850106541

Killingsworth, Jeff, Eric Godfrey, and John H. Haynes. *The Haynes Suspension, Steering And Driveline Manual.* Newbury Park, CA: Hayes North America, 1998. ISBN: 1563922932
Scharff, Robert, and James E. Duffy. *Motor Auto Body Repair, 3rd Edition.* Albany, N.Y.: Delmar Publishers, 1998. ISBN: 0827368585

OTHER PRODUCTS

Auto Shop Safety, VHS/DVD, Meridian Education
Stresses that if safety rules are not followed in an auto shop, serious injury or death can occur. Running engines, moving cars, cars on jack stands or floor jacks, open fuel lines, and other things all have the potential to cause a catastrophe. Methods for preventing accidents are shown and emphasized.
Order #: 24746, www.meridianeducation.com, 1-800-727-5507

Multimedia Auto Shop Safety, CD-ROM, Shopware
This multimedia CD-ROM uses video, animation and still photos to examine the topics of general shop safety, fire safety and prevention, first aid, and safe tool use for mechanics. The segment dealing with overall shop safety emphasizes the link between cleanliness and organization, as well as personal safety considerations of glasses, earplugs, shoes, and clothes. The first aid portion suggests that a certified first aid class be taken, but it offers an excellent survey of first aid practices, including what NOT to do. Correct fire extinguisher usage is illustrated by memorable graphics. The auto workshop is portrayed as a work site of numerous potential hazards, while at the same time the viewer is taught how to cope with the challenges of volatile auto products, damaged electrical cords, and welding cylinders and their contents. The mechanic's tools are shown to be a statement of their owner's professionalism. It seeks to foster that professionalism by describing the safe care and use of hand and power tools, wrenches, auto body tools, and measuring devices. (Windows/Macintosh)
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